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LOW-CARBON DEVELOPMENT IN THE UNITED STATES AND CHINA

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P R O C E E D I N G S

MR. LIEBERTHAL: Welcome. Delighted you were able to make it here through this very inhospitable weather that we tried to arrange for you. I assume most of you welcome the opportunity to get outside to come over here.

This is simply a reflection of one of the great realities that confronts us all and not necessarily as benignly as today, which is the reality of global climate change.

And core -- that was a good segue, wasn't it? -- core, to our capacity to deal with perspective shifts in the global climate and their consequences is our capacity to develop clean energy solutions, not only to develop them, but to test them, refine them, scale them up, and make them commercially feasible.

And so, this is a very high priority issue with enormous practical consequence as we look forward.

The U.S. and China, individually and cooperatively, are critical to this future. We are, as you well know, the two largest carbon emitters in the world today by far. America, historically, cumulatively, is the largest carbon emitter in the world, but China will, after a period of years, assume that title. Not exactly an enviable title to assume.

We have different strengths, different recent experiences in this realm, but our capacity to understand what each other are doing and to figure out ways to maximize results through cooperation wherever possible is, to my mind, an issue of central concern in the modern era.

This is an issue that is technical, is also economic, and it is also very political, and that is true in each of our countries.

And so, coming together on this issue is something that is not easy. Despite great promise, there are just all kinds of complications and of political cross-

currents in both countries as we seek to move this issue forward.

It's in that context that we seized on the opportunity of Qi Ye's coming to Washington armed with the most recent major report on China's progress to this point in carbon mitigation to organize this panel this afternoon and I'm really delighted that we, frankly, were fortunate enough to get the group together that will be presenting to you.

Let me introduce them. I'll introduce all of them now and then we'll ask them to come up simply one right after the other, so I'm not going to stand up in between each of the presentations, but let me say a word or two about each.

Professor Qi Ye, who I've been delighted to call a friend for many years, is a Cheung Kong Professor of Environmental Policy at Tsinghua University School of Public Policy and Management. He's also the director of the Climate Policy Initiative in Beijing.

He serves on a wide array of policy-relevant committees and institutions including the Science steering committee of the Global Carbon Project.

From 1996 to 2003 he taught at U.C. Berkeley. He had received his PhD in environmental science at the State University of New York's College of Environmental Science and Forestry and Syracuse University.

His current research focuses on climate and environmental policy in governance. He publishes extensively in this area. One of his most recent books is on environmental governance in China, which is absolutely fascinating and a very critical component of this entire issue.

He's here to give us a summary readout of the findings of the most recent annual report that he's been involved in.

Secondly will be Mark Muro, who is no stranger to those of you who know Brookings well. He's senior fellow and director of policy in the Metropolitan Policy

Program at Brookings and he manages the programs public policy analysis and he leads a number of key research projects.

He, like all of our panelists, has a list of publications as long as your arm. I'm not going to try to summarize them. They are disparate but significant. He's a member of the City States Group, which is a network of journalists, speakers, and civic leaders who are focused on building competitive, equitable, and sustainable 21st century metropolitan regions.

He'll be reporting on recent developments in the United States in this issue area.

And then last, but not being trite, being very serious, by no means, least, is Casey Delhotal, whose last name I have practiced and practiced and practiced. I'm not sure whether I've gotten close or not, but it's an Alsatian name.

Anyway, Casey is director of East Asia in the Office of Policy and International Affairs at the U.S. Department of Energy. For those of you who follow these issues, you know DOE, in the Obama Administration, has become centrally engaged in clean energy work and centrally engaged in U.S.-China cooperation on clean energy policy and Casey is at the center of the center.

In the Bush Administration she was in the Treasury Department. She has a long and distinguished public policy career. She was at the Treasury Department where she played a very significant role in developing what was the signature energy agreement between the United States and China in the Bush Administration, which was a ten-year framework for energy and environmental cooperation that Secretary Paulson really drove working with Wang Jishan on the Chinese side and remains a very important framework structure for our environmental cooperation.

She was also lead author of the fourth IPCC assessment report. That's

the one that won the Nobel Prize in 2008. And she will be talking especially about having listened to Qi Ye on what China is doing and Mark on what the U.S. is doing, she's going to be focused on what we do together and what we may do together and give her assessment of that.

So, let me get out of the way and have the speakers come up. After all are done, we'll sit up here and have Q&A. We will have quite a bit of time available for Q&A, so we really look forward to a rich and full session today. Qi Ye, please.

MR. QI: Thank you, Ken, for that very generous introduction.

It's so great to be back here at the Brookings Institution after eight months of work in China -- mostly in China, on this report I'm going to talk about today, which I call it -- we call it Annual Review of Low Carbon Development in China, and I do realize China is quite a frequent subject in this town nowadays, and low carbon, whether or not it is truly low carbon we can debate on that.

With me today, my colleagues from San Francisco office, David Nelson, Cath Rollie, and Ruby Barcklay and also from our Venice office, Barbara Brookner here today and they can help me to do the debating.

What I'm going to do today is to just highlight the major findings in this report and also give some examples in how we got these major findings.

Basically, in this annual review, every year we do is we try to understand how the policies relate to the low carbon development, mainly energy efficiency, renewable energy, and the carbon sequestering, how these policies work and what policies actually work better than others and why. And also in this particular report we're also talking about some of the challenges ahead.

In China we say 11th Five-year Plan task for the year from 2005, 2010, then now it's the 12th Five-year Plan that goes from last year, 2011 to 2015. And what we

did not do, purposely, is we don't have policy recommendations. You may find some of the results have some policy implications, but we do not -- we just stopped short making any policy recommendations in this study.

We do -- this is a very much China focused study and we try to make it to be relevant to the audience here and in other places in the world, but we didn't really do the contrast and comparison, so that's one too.

Last time when I was here reporting to you about the last report, basically we did this. We divided the entire economy into five and six sectors including energy, industry, buildings, transport, agriculture and forestry, and for this year, this report, we did the other way around. We cut the pie by, you know, looking at the thematic areas -- technology, policy, institutions, economic structure, financing, and also the actors in the low carbon development in China.

What I call the key findings are ten of them. The first one, if you look at the entire five years of the 11th Five-year Plan, what is the main change, it is a reversal of an increasing trend of energy intensity in five years. Still, the energy intensity now, it's very high, compared even to the United States and compared to Japan, Europe, it's still very, very high. So, I will talk a little bit about that.

And also, this five years is a period where we see the very fast growth in renewable energy. However, the energy mix, the share of renewable energy, has not improved very much.

Thirdly, it is the technological progress that accounted for the majority, 70 percent, of this energy intensity reduction, not a structure change. It is a technological progress. But look at the structure, it is useful to think about the structure in three different layers -- the overall economy, and the industrial structures, you know, including various sectors, and also with the products.

They actually give very different pictures. Overall, as I said, the structural adjustments account for just about one quarter, a little bit less than one quarter, contributed to the energy intensity reduction, but when we divide them, we see the economy for the -- the overall economy primary, secondary, tertiary sectors of the industry. The economy just grows to be more energy intensive.

However, when we look at the industry, industrial sectors, and the products, it becomes lighter and become more, you know, technologically intensive. So, it contributed to the reduction of energy intensity.

Another very interesting change is this geographical redistribution of the industry. China, a little bit like in the United States, east, middle, and a west, and the eastern parts being the most economically developed.

But in the last five years we see tremendous shifting of industry from the east toward the middle and toward the western part of the country. And this change, while contributing to improvement in technology, economic development in the middle and in the western part of China, but it is also contributing negatively to the energy intensity.

So, even though -- it's very interesting, even though you look at each area you find they have achieved a target, but overall, it made a negative contribution, say, a half percent amount, 19.1 percent of the total energy reduction.

And if you look at the low carbon development policies, the main character with the low carbon development policies in China in the last five years is something we call this national mandate with a lot of government funding. This characterizes the low carbon development policy.

Previously there are mandates, probably not that strictly enforced and implemented. This time it's different. But what is different even more is this time, the last

five years, there was a lot of government funding for achieving the target.

Now, if you look at this whole picture, you know, what characterizes the whole picture now, it is something we call an X-shaped curve, being increasing total volume of carbon emission, energy consumption, and a very big -- very sharp decrease of energy intensity. Then we have these two curves, which I will show you in a little bit.

Then energy use in buildings and transport sector, which we found a problem for the United States. You have this problem because this is the area you find the majority of the energy consumption. We thought that is less of a problem in China.

But this last five years changed the picture. This is the area where we see the rate of growth, very fast, much faster than in the energy sector, so, this has become the next biggest concern.

Now China being the largest CO2 emitter and the -- we say this change probably took place in 2007, 2008, but there is no question now, China is the largest emitter. And the gap between the number one and number two, United States, is enlarging. This gap is very big now and it is enlarging, and then this and many other factors contributed to this daunting challenge in the next five years -- well, next four years for the 12th Five-year Plan.

So, these are the ten -- I call it -- major findings.

Let me just give you a little bit of data on this. The first -- if you look at the trend of this energy intensity in the last three decades, starting in 1980, so over all we see this very fast declining trend from 1980 to 2002, that this is a time when you see every year you find more than 5 percent of decrease in energy intensity. This is quite amazing, this is really quite amazing.

So, the Chinese economy becomes a lot -- more efficient, energy efficient, every year, but this trend changed from the year 2002 to 2005 where this

declining trend was reversed. So, there was an increasing trend. This became a very big concern and this is why the government set a target of decreasing. Cut this energy intensity in five years by 20 percent.

So, that was the target. Then looking back now, China reported -- the central government reported a cut of 19.1 percent. So, it's a pretty good drop. When you compare that, for instance, to -- it's not always right to do this kind of comparison, but if you compare it to the United States, it is just -- more than three times the United States, in this same period, there was a cut of 6.1 percent in energy intensity versus 19.1 percent.

Sorry, this slide does not really show very well. My colleagues helped me to put together this. If you compare China, the upper curve, with the United States, you see -- I mean, you still see there is still a considerable gap in energy intensity between the two countries.

For renewable energy, China started the 11th Five-year Plan with, you know, something like a 6 percent. Then this last five years, in terms of solar, PV, wind, and other forms of renewable energy, the increase was amazing.

Nevertheless, in these five years, the overall energy use has been growing very, very fast. People like to talk about, you know, one power plant every week. I don't really have the data, but that's probably close to the truth anyway.

So, because of that, the share of the renewable energy did not really improve that much in these five years. It went up from 6 percent, roughly, to roughly 8.5 percent in five years.

Still, that is the fastest growth in the last three decades. Forestry, you know, being carbon (inaudible 0:20:35.0), sequestering carbon, also grew very fast at 4.5 million tons of carbon dioxide each year sequestered due to reforestation in China.

When we look at the overall picture, you can see mostly it is the energy intensity that contributed to this low carbon, avoided carbon emission. Just about 90 percent of that comes from this energy intensity and another 10 percent from the energy mix.

Now, we can go just one step further to look at the energy intensity reduction. It is the technology. Technology contributed about 70 percent in that and the structural change -- economy, industry, and product -- that contribution is about 23 percent.

So, this highlight-- kind right now-- is still at this stage a very fast urbanization, industrialization. The overall, the economy is still very, very much energy intensive. The structure is not moving in that direction. That's why a lot of people are very concerned, including the central government, of course, to change, to transform this, what we call, the mode or the model of economic development in China. Ken has done a lot of work on that.

When we look at the technology, the energy efficiency, renewable energy technologies have been widely used, deployed in China. We put pretty much like a McKinsey type of a curve. So, the progress has been quite amazing.

Now, the X shaped curve that I was talking about is just like this. When you look at the green curve, that is the energy intensity. That has been declining, 19 percent, very fast. At the same time, though, carbon dioxide, the overall emission, has increased more than a third, more than a third in five years. So, that has been going up very fast.

The reason I want to highlight this curve, because a lot of debate around the Chinese climate change action, policies, it's really about this curve.

From the Chinese government's perspective you often site the green

curve, right, declining energy intensity from everywhere else, people are more looking at the red curve, you know, what is going up.

So, I think the more complete picture would be to look at both of them and then draw our conclusions, and even better, to think about our policies.

Now, speaking of policies, the policies we divide into three categories, the purely administrative measures, the second is government funding, you know, for incentives, thirdly, the market. We even did a rough calculation: the administrative measures, about 20, 23 percent, and incentives, government funding played -- contributed to, you know, more than 60 percent. Really, the market did not play that big a role, which probably is the problem, because -- and because of this, we say the policies in China in the last five years were effective in terms of achieving the target, but not necessarily efficient.

In fact, efficiency of that policy, of that investment, is a key concern.

Investment, 1.7 billion yuan -- excuse me, 1.7 trillion yuan was invested in renewable energy and about 860 trillion -- billion yuan invested in energy efficiency. Overall, that's 2.5 trillion yuan. That's a lot of money, you know, invested in their -- you know, we often say -- we often hear from the media, there's this competition between the number one emitter and the number two emitter. Really, if we look at the investment, China is really winning the competition on this front.

What is worrisome is something we just mentioned, this consumption sector, the buildings and the transport. This sector -- this consumption sector grows very fast, 41 percent in five years versus the overall carbon emission growth that's at 35 percent.

So, this, with the urbanization, very fast urbanization, and this becomes, you know, a very big concern. Now, last year, 2011, China has the -- for the first time

had the urban population exceeded the rural population. And urban residents will consume three times, at least, three times of that amount of energy as a rural resident. So, this becomes very much of a concern.

Now, finally, about the 12th Five-year Plan, there are a number of targets set, a number of policy innovations, but still the challenges are huge. Four different kinds of challenges, one is this urbanization industrialization I mentioned in the middle stage of that. It's really hard to stop it and this drives up the energy consumption.

Second, this low hanging fruit in the 11th Five-year plan, much of that has been gone. Then local government, their drive for development has been huge. So, really, when you look at the Chinese target for the 12th Five-year Plan is 7 percent, and many, and I would not say most, but many of the provincial governments, they have a target of at least double of that.

So, finally, for the renewable energy target, it's going to be really hard to achieve.

If you compared the central target and the provincial target, you can find a total of 1.5 billion tons of energy, tons of coal equivalent. That's such a big gap between the central target and the provincial target.

And finally, consider the gap between U.S. and China. At the end of 2010, Chinese emissions -- carbon emissions, in our calculations, 21.9 percent, almost 22 percent higher than the United States. And this gap is enlarging. By the end of this Five-year Plan, and we'll expect to have nearly half of that, nearly 50 percent of that more than the United States. This brought huge pressure internationally and domestically.

Let me just, finally, finally, I want to bring this data here -- I want everyone to look at, hopefully we can generate some discussion.

By the end of September, the NDRC, National Development Reform

Commission, released this data, 1.6 percent out of 3.5 percent of the target for that year, last year, was achieved in nine months. That means there are only three months to go to achieve the other half, more than half, of the target.

Now, when you look at the provincial data, most provinces, they have declared, they have all achieved or exceeded their targets. I want to let you know that many of these provinces were actually alerted, even warned, by NDRC. So, the reason I want to put this here is when we look at China, you really need to look at -- it's not just one big rock. There are many levels of local government, sub-national government, there is a central government.

For the central government, the willingness to control the energy use and carbon emission is very strong, but on the provincial levels and the local levels, there are different stories. Games are being played at many, many levels. I hope to -- I would like to stop there and hopefully we can have some discussion on this later on. Thank you very much.

(Applause)

MR. MURO: Well, thank you, Qi. That was a fascinating update on Chinese dynamics.

Now, I'd like to review the U.S. situation somewhat with an eye to compare and contrasting American dynamics, but also with an eye to hinting at some areas in which cooperation between the two countries could be mutually beneficial. In that sense, if Qi Ye's provided the thesis this afternoon, I'll provide the antithesis or maybe just another thesis, and perhaps Casey will draw us to a hopeful and elegant synthesis of the day.

And I'll warn you, some of my remarks will be a little dour at the beginning but I'll get more hopeful as I go along. So, I'm not going to use PowerPoint.

Let's look at the U.S. situation, which in some ways resembles China in its heavy focus, I think, on technological and economic responses to the greenhouse gas challenge. In this, I'm going to draw an assessment my group provided with our recent report, "Sizing the Clean Economy on American Conditions" and also some forthcoming new work on some policy issues. And I'll start at the federal level.

Like others, my group at Brookings assumes that the de-carbonization of any market economy depends on the existence of a clear regulatory framework that structures vibrant and steady demand for clean solutions, adequate finance for scaling up clean new technologies, and I think we saw a lot of finance in the Chinese story, and then continuous technological innovation.

How does the U.S. look on these prerequisites for low carbon development? Well, not so good if you ask me. And I'll begin with the dour stuff. Notwithstanding, you know, a still formidable capacity for technological innovation, I think the U.S. is struggling with a series of significant policy gaps and uncertainties that are being exacerbated by political chill on spending of all kinds and on responses in the climate sector in particular.

On the structuring of a clear regulatory framework that catalyzes adequate demand, the U.S. continues to wrestle with a number of major problems. The lack of any national carbon pricing mechanism puts low carbon goods, services, and electricity at a cost disadvantage, which is a colossal problem in our market economy.

The absence of a national clean energy or renewable energy standard for utilities further depresses demand as do structural and regulatory barriers in the electrical power sector, and for that matter, the existence of myriad fossil fuel subsidies, some 72 billion of them, or so, over the last seven-year period, exacerbates the problem.

So, the framework is partial and shaky in this country, quite different from

some of the frameworks in China. Nor are conditions significantly better when it comes to the adequacy of finance for scaling up novel and often capital-intensive low carbon systems.

On this front, the entire development chain through which clean energy goods and services are invented, proven, deployed, and scaled up commercially in this country and much of the west has long been beset with serious finance challenges.

Clean energy assistance remains yet novel and more expensive in their delivery of energy than conventional carbon solutions, and they're therefore hard to finance, an elementary fact, but a bedeviling one in this country.

So, for that reason, a patchwork of often time limited start and stop federal finance programs, direct grants, loan guarantees, tax credits and the like, has been set up to address the investment challenge. It's one of the crucial strategies of this country.

Heavily boosted by the 2009 Recovery Act, these programs have frequently entailed tax and other subsidies that range from the now famous loan guaranty program of Solyndra fame, to the so-called 1603 Treasury Grant, to the Production Tax Credit to Investment Tax Credit, Advanced Energy Manufacturing Tax Credit, the list goes on. We're highly dependent on these time-limited subsidies.

But here's the problem, just as cash-strapped governments in this country and around the world are pulling back on all kinds of subsidies, so is the debt plagued U.S. heading now for a period of subsidy retrenchment. In America, my forthcoming work is suggesting, that absent congressional action, federal energy innovation, manufacturing, and deployment subsidies could decline by as much as three-quarters, in theory, from 2009 levels.

So, in that sense, you know, we may see several of these provisions

have already expired. The 1603 Treasury Grant, the Production Tax Credit is in question now, and so will dozens of other programs.

So, it's quite likely that the start and stop nature of U.S. policy support and finance that has led to a boom and bust nature of our energy sector in renewables could lead to a plain old bust period of substantially reduced finance support coming in the next four to five years.

Clearly, collaboration between China and the U.S. on clean energy finance, if not so much on regulations and demand driving, which are more our problems, could be opportune, to say the least.

As to our innovation system, it's important to state that the U.S. continues to posses an enviable early stage technology development system, and that while the need for renewal has continued to pump out important technical gains, America is still home to some of the most innovative solar firms from technology leaders like First Solar, making the advanced end film technologies, or Sun Power Corporation, manufacturer of the most efficient crystal and PV panels, and we remain a global leader in venture capital investment in clean energy research, you know, far surpassing that of really all other nations.

But with that said, the recent stimulus polls of energy RD&D investments is also soon, at least, under question in the current finance and political environment. Budget certainty threatens the Department of Energy's important recent efforts to renovate the format of the nation's energy research system. Funding challenges will likely slow scale up with key new programs like the Energy Frontier Research Centers, ARPA-E and the energy innovation hubs.

So, the bottom line is that in many ways the U.S. stands at a particularly uncertain juncture with respect to clean energy and climate mitigation responses. We've

failed to adopt a comprehensive energy and emissions strategy and policy, had the policy and scale up problems one might then expect.

So, in short, I'm going to offer a somewhat snarky characterization of the U.S. climate and clean energy situation: we lack the kind of regulatory environment and demand we need, we lack the finance we need, and we're slipping in our innovation capacity.

So, other than that, we're doing fine. But, you know, some serious challenges that I think, you know, in some ways some of them point to some possible areas for China-U.S. cooperation, but we'll see what Casey has to say.

But I do want to say, this is not the whole story, even at the federal level, and meanwhile, like China, the U.S. is a big country and I was extremely interested at the discussion of the relationship between the national government, the provinces, and cities. In some ways, some of that plays out in reverse in this country.

Let's start at the national level. I mean, I've mentioned, first, there are some strengths. The early stage innovation eco system in this country is without parallel. It's driven technology development and process innovations effective enough to ensure that the cost of wind and solar power is now competitive with fossil fuel in some circumstances, no matter what the subsidy environment.

So, again, technology progress is leading to economically viable technologies, somewhat, as you were pointing out.

In addition, the nation -- in China -- the nation has made progress on building demand for regulatory action in some areas. Absent global structures or national structures, we have states in this country, and the biggest recent bright spot on this -- or nationally, though we have other ways to build demand, and the biggest bright spot, I think, somewhat under recognized is the importance of the Obama Administration's

recent announcement that it would double the nation's vehicle fuel standards to nearly 55 miles per gallon, which, by 2025, could lead to a 50 percent decline in emissions in the vehicle sector.

Likewise, the EPA has continued to move ahead with most of its -- not all, but most of its planned regulations on power plants, which produce about one-third of U.S. greenhouse gas emissions. And in 2010 there was President Obama's Executive Order calling for the federal government, the nation's largest single vender, to reduce GHG emissions by 28 percent by 2020.

These are significant actions, not the kind of global, overarching, dedicated climate rules, but truly important.

So, these are executive actions taken in the absence of legislative momentum, and Congress, they do fall short of a comprehensive energy and climate policy, but they do represent, you know, significant steps forward. But fortunately, that's not all even -- that is going on in the U.S. now. Happily, ours is a federal republic, so while the national government has been, and will likely continue, slow to act on key issues, states, metropolitan areas, and cities retain the power to get things done themselves, and in some impressive ways, are.

On the regulatory demand side, California has adopted the nation's first state administered cap and trade regulations to address climate change. It's a significant, sub national experiment in this country.

Twenty-nine states maintain renewable portfolio standard, a not insignificant piece of the demand-driving structure in this country. And states are ramping up their energy efficiency standards an effort -- state energy efficiency investments separate from the Recovery Act, hit record levels in 2011. It's something like $6 billion in state subsidy.

And then on finance, Connecticut has set up the nation's first green bank that will provide low-cost financing to clean energy projects. We at Brookings are working with Reed Hunt's group to, you know, help diffuse that kind of idea to other willing states.

So, again, sub-national progress is a viable strategy for at least parts of our challenges.

A recent paper from my group has also noted that state side clean energy funds, which generate hundreds of millions of dollars a year from small exactions or surcharges on utility bills for clean energy purposes have leveraged something like $12 billion in renewable energy project finance in the recent years.

So, not a huge amount, but these are important pieces, and you can see an architecture of a distinctly American approach here, clearly quite different, and maybe inverted in some ways, from the Chinese model.

For that matter, numerous regions in the U.S. lay at the forefront of accelerating low carbon innovation through cluster and other regional industry strategies. Fifteen regions, from New England and Northeast Ohio to San Diego, are working together under the banner of something called the Advanced Energy Economy, to address innovation pipeline gaps and accelerate regional industry cluster growth in the energy space.

Four other regions, in what is called the Climate Prosperity Network, are pursuing their own assertive economic strategies to move to a carbon free future. In the Puget Sound region, business leaders worked with my program here at Brookings to craft a metropolitan business plan for making the Seattle area a world center for the export of cutting edge energy efficiency technology, building control, software, and consulting.

Again, these are piecemeal solutions, but they are actual and significant

American efforts.

Now, to be sure, signs of retrenchment have emerged among the states too, but even so, many governors and state legislatures, counties, and mayors, and city councils, are continuing to craft really quite innovative responses to the nation's climate and energy challenges.

You can't ignore those kinds of efforts when assessing the United States' situation and when comparing low carbon development trends in China and the U.S.

So, you know, where does that leave us as we think about Chinese-American cooperation on low carbon development? And I think, clearly, that's Casey's domain, so I'll leave it in her capable hands, but I can't resist just a few observations.

You know, clearly, the regulatory regime with which we choose to structure demand in our market is our responsibility and our problem and ours alone. I don't think China can help us with that, but when it comes to both finance and technology innovation, these are areas of long-standing exchange and I think deepening conversations, and one can imagine possibilities for extended bilateral collaboration that answer to the current mutual needs of the two nations.

On technology development, you know, China wants more of it and is seeking to boost its innovative capacities. At the same time, the (inaudible) U.S. system, after decades of maybe over emphasis, in some ways, on early stage R&D needs to work more on the process in deployment innovations that come with building out large energy systems such as China has proven adept at.

Surely, that's an area for productive exchange provided, you know, difficult IP issues can be worked out. As to finance, the U.S. clean tech industry and its regional clusters need it badly at a time of declining public subsidies and fiscal distress in this country.

Surely, you know, Chinese capital, of which much exists, could play a constructive role in helping to finance the scale up of low carbon and energy efficiency technologies in this country as investment opportunities.

It could be that a genuine win-win solution, if ways could be found for Chinese entities to diversify their portfolios by helping to finance U.S. companies not currently well served by conventional markets. You know, these are symmetric possibilities.

But, enough. With that I'm going to convey this discussion to Casey, who is going to discuss some possible areas for U.S.-China cooperation in the next few years. And, thank you.

MS. DELHOTAL: Thank you. Again, my name is Casey Delhotal. I'm director for East Asia Department of Energy. The East Asia office is sometimes referred to as the China Office. We are the favored pupil and problem student of the DOE family. We get a lot of attention and a lot of both positive and negative press.

So, I want to thank Ken for the generous introduction and the beautiful pronunciation of my name, but I wanted to start a little bit by first of all sort of discussion what DOE does.

So, a lot of the miscommunication you see in the newspapers and in some of the outside press is not a full understanding of DOE as an organization, let alone what we do with the Chinese.

So, I'm going to start a little bit with DOE as an organization and then talk about our history with the Chinese government. We actually have a very long history. Most people are sort of surprised when I start at the year 1978 because they think it's a brand new program with China. And then I'll talk about our current initiatives, which are critical for our U.S. industry as well as helping China develop their own clean energy

technologies, and then talk a little bit about some of the major challenges.

So, first, in a nutshell, DOE, we have four major pillars. In no particular order, the first one, the National Nuclear Safety Administration, which is about weapons and nonproliferation. We are very interested in helping China with nonproliferation issues.

The second one, the Energy Information Agency. Many of you have heard of NIMS and the projections and the energy sector that EIA produces. We do work with the Chinese on statistical analysis.

The Office of Science, this office, think nutrino particle experiments, accelerators, fission, fusion, all of those very exciting pre-application type R&D projects.

The fourth is the Office of Energy. The Office of Energy is the pre-commercial R&D office. It deals with things like fourth generation nuclear power, carbon capture, utilization and storage, materials, new chemicals for batteries, for PV, for wind. It's very much in the R&D stage prior to commercialization.

Only recently have we added ARPA-E to our portfolio where you have a loan guaranty program that actually bridges the gap between DOE's traditional R&D programs and the commercialization of these products.

DOE has not been traditionally in that space, and this sort of valley of death, as many people call it, is a new area for DOE and has traditionally been taken up by the private sector partners that DOE has. So, keep that in mind when you think about how we cooperate with China.

So, the history of DOE and the Chinese government does start in 1978 with the signature of the SNT agreement with China. WE started our first programs in the late '70s, mainly through our Office of Science, so we're talking about, you know, nuclear physics experiments, we're talking about high energy physics experiments.

These experiments, you also have to remember where China was in 1978, 1979, we were in a mode of helping them develop their laboratory system, helping them train new physicists. They had been coming out of a long period of isolation with the rest of the world, getting them up to speed on the international standards that are needed for these kind of experiments.

So, it was very much in a help China mode. Up until even the late '80s, we were very much giving to China and helping them out.

In the late '80s, we started moving and making more progress on some of our experiments and what stopped us from keeping the momentum going was the lack of an IP arrangement.

In 1991 we finally got an annex to the SNT agreement that has a very basic IP arrangement where China owns the IP in China and the U.S. owns the IP in the U.S. It's very basic, but for non-applied research it was sufficient to keep the ball moving.

The 1990s come around, 1993, China becomes a net exporter of energy. They start becoming more concerned with how to more efficiently burn coal and fossil fuels, how to more efficiently produce electricity and distribute it within China.

We expand our cooperation to include more things that are in the sphere of our Office of Energy, some of the R&D to create to better coal powered plants, some of the R&D to create better transmission lines, that type of thing.

China is also adding more cars to the road at this point. They're more of a player in the fossil fuel, the global markets for oil. We start working with them on these types of issues, the management issues, the policy issues of managing oil and fossil fuels.

By 2000, you know, most things have changed. The economy is extremely dynamic. They are building up capacity in a way that I don't think we've ever

seen any other country do before. They had western trained scientists who are coming back to China who were setting up institutes within universities, who were training new cadres of Chinese students on the western practices for physics, for materials development, for chemistry.

You know, right now when I go to even some of what's in China considered second tier universities, I'm seeing students who are not only fluent in English, even though they've never lived outside of China, but they can write journal articles, they can get patents, they can write their dissertation in English and Chinese on battery chemistry.

So, you're seeing a huge build up of the capacity of the Chinese university and research system to handle this.

DOE's cooperation with China, therefore, is changing. We are not helping out the developing country we were helping out in the 1970s. We are now considering them a partner in the same way we consider Japan or Europe a partner. We are bringing in our industry.

We are working to bring in our universities and our labs to work with their universities and labs, and it's much more of an equal partnership and there is much more coming out of it and it's much more innovative.

We find that working with China is extremely important. You know, innovation is kept alive by exchange of ideas, cross-fertilization, competition. You know, for us to be more competitive we need to work with the Chinese. We need to see what their idea is, where they're going, what their needs are. They need to understand what we're doing, what we've tried before, what's worked for us, what hasn't worked for us, so that we can both keep moving forward quickly.

These are -- you know, R&D is a global issue and you can't just pack up

your toys and go home and sit in your little lab and only do your thing. To be innovative you really have to be exchanging ideas and working with others.

So, we're at a point now where, under Paulson, this started to some extent with the ten-year framework, but particularly now under the Obama Administration, we are at a point where almost all of our partnerships are public-private partnerships.

The Obama initiatives, which are what we operate under now and are the cornerstone of our relationship now with China in the clean energy area, are all based on public-private partnerships. The private sector is heavily involved in almost every aspect of what we do.

Even in the basic research areas, the Office of Science brought in their private research institutes to work with us and the Chinese institutes in the areas of the energy development, you know, we have industry forums, we have jointly funded private sector, public sector activities, actual research activities, we have Chinese scholars working at private institutes in the U.S. doing this type of research.

It's very much based on what our industry wants and what the DOE feels is necessary to keep the research moving forward.

So, the seven initiatives from the Obama Administration, kind of the flagship one is called the Clean Energy Research Center. It focuses on clean coal, electric vehicles, and energy efficiency for buildings.

DOE has provided approximately a fourth of the money. It's a $150 million project over five years, so about $37.5 million of that is from DOE. Another $37.5 million is from the private sector in the U.S. The other $75 million is from a mixture of Chinese government and Chinese private sector entities.

We have been working on this for approximately two years now. We just finished with an IP agreement under the Clean Energy Research Center and we're

starting demonstration projects. Some of you may have noticed in the run up to the Hu visit and now the run up to the Xi Jinping visit, there will be press announcements about new demonstration projects under the CERC. That's what we're moving towards now that we have an IP agreement.

Some of the other initiatives, we have a global shale gas initiative that's actually run by our Department of State, the DOE is very involved in, so is our oil industry. It's very much about promotion of U.S. shale gas technology in other countries, in this case, China.

We have a renewable energy partnership. Because of the trade issues people are kind of surprised by that. It's actually two industry forums, it's a renewable energy forum and a bio fuels forum that we run jointly with USDA, and it is about getting industry partners and government partners in the same room to discuss issues, hopefully, to prevent things like the solar trade petition that's currently going through.

One of the other initiatives is the 21st Century Coal Initiative. Again, it's an initiative to help promote private sector demonstration projects of clean coal, whether it's carbon capture and storage, enhanced oil recovery from the carbon capture and storage, or in some cases, coal to liquids. This is basically a way for U.S. and Chinese private sector entities to have government blessing on both sides to do these large, very expensive demonstration projects.

And so two more, electric vehicles, we do an Electric Vehicle Initiative. It's about standards and testing. Again, much industry involvement. If we can standardize plugs, if we can make testing standards easier to understand on both sides, trade in this area is easier to facilitate.

And then, finally, the Energy Efficiency Action Plan, which is a new Obama action plan under the ten-year framework that was started by Secretary Paulson,

and that actually also focuses on demonstration of energy efficient technologies. Our industries are very excited about getting into the Chinese market and demonstrating their technologies, and many of our developers here in the U.S. are interested in bringing Chinese technologies here that might be lower cost.

There's a large industry forum connected with that as well and it's being facilitated by both governments having this platform and being able to sort of bless, if you will, some of these projects and some of the trade that's resulting from these.

So, those are our major initiatives. They're important for a variety of reasons, not only from the private sector point of view and trade implications, opening up China as a market, opening up the U.S. as a market for Chinese goods, but also from a national security/energy security point of view and a national security point of view.

We include, in anything that we're doing with nuclear energy we include the nonproliferation issues. We actually do a lot of consultations with the Chinese government about strategic petroleum reserves. You know, the big IEA release last year was done in coordination with the Chinese government, so we do have to coordinate on global markets in this area.

There is also, from an innovation point of view, I mean, I don't think I can emphasize this enough, but Secretary Chu feels like the only way to keep the U.S. industries competitive is to be engaged with China and to cross-fertilize with the Chinese industries and that, you know, isolationism isn't beneficial to either one of us, a trade war isn't beneficial to ether one of us, and that by engaging with appropriately, this is actually a way to move the ball forward faster.

So, that's a big rosy picture. I mentioned that we are also the problem child of the DOE family and the problem child probably comes in a variety of things.

I've been asked about what the challenges of working with China are and

I can give you a whole laundry list, I mean, everything from stove piping in the ministries to, you know, opaque funding on their side and, you know, a whole list of minor issues.

But I think there's really two issues that could sink our cooperation in this area. The first one, and I know both of them are bandied around a lot, but the IP issues are extremely important. I mentioned the SNT agreement very specifically because of the IP agreement that is there, that is currently the only overarching IP agreement that we have in this area.

Over the last, about, year and a half, under the Clean Energy Research Center, we spent a great deal of time and effort to negotiate a new IP agreement for the CERC. And this is a pilot project, it's still experimental, but the basic fundamental clause in this agreement is that the inventor owns the IP, not a government, not the person funding the project, the inventor who invents it owns the IP.

There are also clauses, because this is a cooperative research project, on how the IP can or can't be shared, sometimes it's just for academic use, sometimes it has to be paid for, but all of that is part of an agreement. When you come in and you decide on a joint research project you have to determine how the IP will be shared, if any is developed.

This is very forward thinking on the behalf of USG as well as the Chinese government. There is not another example of this in our cooperation with each other. It is certainly not tried and tested; it's brand new. We have not run up against an issue that we then have to, you know, fall back onto our agreement and try and solve, and until that happens, you can't say that it's successful, but we are very excited about having this on track at this point and moving forward.

What this IP agreement has also allowed us to do is bring in private sector funding. So, as I mentioned before, roughly a fourth of the CERC is being funded

by the U.S. private sector in cash, and in order to get companies to write $300,000 to a million dollar checks, you have to have an IP agreement that their IP lawyers read and are happy with. It has to follow U.S. law, it has to follow Chinese law, the companies have to be happy with it.

So, we're very excited about this.

In other areas if -- you know, that only covers the CERC. In other areas, if this becomes a problem, we have seen projects derailed by lack of IP protection. We're worried about some of the major demonstration projects that are being proposed and negotiated now being derailed by the lack of IP protection.

So, this continues to be a big issue for our cooperation.

The second is the trade issues. I'm sure all of you have heard about the Solar World petition. There is a wind power petition also going through. There's been some press about a potential EV petition being kind of instigated by some members of Congress. There's the unfortunate case of the American Superconductor and the Sinovel dispute on IP right now.

These are, while they don't actually directly affect DOE programs and they are not part of DOE programs -- we don't deal in commercial solar panels, we don't deal in commercial wind turbines or commercially available EVs -- you know, politically what this does is put a bad light on our programs. It keeps us from getting money from the private sector, it riles up Congress.

In the last budget round, in the House Appropriations, there was a rider in DOE's budget about not working in China, not just cutting out our funding, but having actual language that said DOE cannot work in China.

We could basically lose our program as, you know, the tensions become greater over this, and so we are watching this very closely. We are using our contacts

with counterparts. DOE has roughly six major counterparts in China.

We use the opportunity of the Secretary going to China, of the Secretary attending meetings with high-level Chinese officials to, you know, explain to them our position on the trade issues and how we would like them resolved before they spin out of control. And DOE has been very forward leaning on that in terms of, you know, trying to work with the Chinese counterparts and figure out a solution before it spins out of control.

So, I want to leave it there so that we have plenty of time for Q&A. I know I covered a lot of stuff, but I think people find it interesting to hear the whole spiel, but I am happy to answer any questions during the session, or if you'd like to contact me afterwards, I have plenty of business cards. Thanks.

(Applause)

MR. LIEBERTHAL: I want to thank the speakers for extraordinarily straightforward, candid, and rich presentations. There's really a lot on our platter. While they're getting miked up, let me frame one issue and then I'm going to open it to the audience.

Let me say, by the way, before I open it up to the audience, a couple points. One, in case you missed any of those points in these presentations, we'll be posting a full transcript of this session, including Q&A, in a few days on the Brookings website. And in addition, Qi Ye has agreed to post his slides on our website, so both of those will be up there within -- certainly by early next week. I encourage you to consult with them.

Secondly, when we turn to Q&A I'll ask that you identify yourself and your institution and that you wait for the roving microphone to get to you so everyone can hear you, and that you keep your questions short and have them end in a question mark.

If you want to direct a question to a particular speaker, please feel free to

do so. If you just want it for the panel, that's fine too.

The question I want to raise, just to get things going, is the following: In the U.S., even though the federal government is falling short in a lot of ways, as Mark suggested, on our domestic policies, nevertheless, when we have regulations and laws, we implement them so that what we do decide, formally, does get done and there are a lot of NGOs out there ready to run to courts if we fail to implement these.

As Qi Ye pointed out, one of the biggest issues in China is that the national government is much more enthusiastic about a lot of this than provincial, municipal, county, and township governments are, so there can be a significant lack of symmetry in goals and policies as you go down this system. In other words, to put it slightly differently, national laws and regulations don't necessarily get implemented with the rigor that their equivalents in the United States do.

I wonder, Qi Ye, whether you could, since you do a lot on governance regarding clean energy issues, and many in the audience are more technical people, can you give us, in kind of capsule summary form, an understandable form, now this can happen in China? I mean, the image of China, among many from the United States, is this is a one-party system. While it isn't totally lock step, it nevertheless is a pretty strong political system.

How is it that the center doesn't get its way more effectively in this area than you described?

MR. QI: Well, that's a great question, Ken. China actually makes a lot of laws, the renewable energy and energy saving law and they get -- renewable energy was enacted in October 2005 and played a major role in the 11th Five-year Plan. And shortly after Copenhagen, China revised renewable energy law and in 2007 revised the energy saving law.

But as you pointed out, the Chinese system is very different. They actually can get a lot of things done before law is even made. If you can compare and contrast that from the United States, you get the law legislated and the implementation follows quite naturally. The difference is, it's really hard to make any law passed here. When you look at 2009, Waxman-Markey became really, really hard, I think, you know, the surface differences between the two countries as I see it.

I think one of the problems now with China is, a lot of things are just happening real quickly. You can't really wait for laws to pass. In this area of energy intensity, the government could not wait, with it happening within five years. So, within one and a half years you have to make some government regulations there and to enforce it.

And the problem really lies in this competing interest between the central government, who wants to do this, wants to take climate change as an opportunity to change things domestically.

On the other hand, though, the local government, the sub national government, they were more concerned about their own interests, quite naturally. So, I think that really brings in the difficulty.

I hear from Mark, actually see the other way around here in the United States. You know, the federal government is much harder, but the local levels and the states and metropolitan areas and municipalities, a lot going on. I think just different drives, different factors over there in terms and also highlight the differences in governance.

MR. LIEBERTHAL: I will add, when it comes to things like getting scale and consistency of regulation and that kind of thing in the U.S., it's a problem if it's local government led because different local governments have different standards.

MR. MURO: Right.

MR. LIEBERTHAL: In China, it seems to me, local government leaders have a primary interest in maximizing GDP growth and that runs against some of these other priorities. So, each of us has our own peculiarities.

Let me open the floor to questions and I will try to get around to everyone by the time we're done. We have quite a bit of time. Yes.

MR. SCHILLING: I have two, one for Qi and one for Mark. Should I do them both at once?

MR. LIEBERTHAL: Sure.

MR. SCHILLING: On China --

MR. LIEBERTHAL: Excuse me, first identify yourself.

MR. SCHILLING: I'm Judge Schilling, I'm the chairman of the Millennium Institute. And we've developed an elaborate model of China, a system dynamic model linking economic, social, environmental factors and work with the Institute for Science and Technology Information in China on this, and we've used it to look the goals of meeting -- the means of meeting the goals of reducing energy intensity, and technical changes and efficiency changes by themselves don't do it, so we've looked at some other what we call consumption or behavior changes.

And one of the major ones is if the size of housing unit -- a person per capita doesn't grow as fast, that will make a major increase in reducing the greenhouse gas emissions, because less cement and steel consumption, and another one is the reduction of shifting to automobiles and encouraging more public transportation and things like that and a little bit less road.

So, to what extent is the government willing to impose either property tax or other regulations that would encourage these behavior changes both to help meet the

targets -- interestingly enough, we can show it produces other benefits, that agricultural production goes up if they slow the growth of housing size.

MR. LIEBERTHAL: Okay, and you had a question for Mark also.

MR. SHILLING: Yeah, it's very interesting the difficulties in promoting the introduction of technological change and stuff like that, but a very interesting book has come out called *Design for Environment* by the Center for Resilience and it makes a very important point, and how much this can be emphasized in the work that companies which have been pressured by environmental groups or others to introduce more efficiency, not only with energy but with waste removal and stuff like that, have discovered something interesting: they save money and their profits go up.

So, how we can get that more introduced into the system, particularly since we claim to be free market capitalists, which is supposed to be maximizing profits. Thank you very much.

MR. QI: That's an excellent point you just made. We can identify three pillars for this low carbon development in China or any other country, I would agree, those would be technology, the economic structure, and the consumer behavior. And consumer behavior, as I said, we did used to think it's not a problem in China, but now we do think it's a huge problem because now people want to get the bigger, bigger houses and they want to drive big cars, they want to do whatever they have watched from their television, you know, from Hollywood and other places, of course.

That becomes a really big problem. Right now, the square footage wise, China is still pretty low and per square meter or per square foot of the energy consumption, still very low.

However, that's going up very fast because people want to have much bigger houses. You ask people how much they want to have, they want to have, per

capita level, they want to have 42 percent -- this is a survey -- I mean, excuse me, 420 square feet per person. That would be amazing if that ever happens, whether it would probably happen. That would be, you know, a really big problem, not only in operation of the building, but also in constructing, in manufacturing the construction material.

I think this has been identified as a major issue, but the policies are not quite there yet. But the property tax, not for the energy saving purposes, but for controlling this very fast overheating in this housing sector, the property tax has been experimented in quite a few cities now and it's expected to be put in place, I would think, in a very short period of time.

MR. MURO: That's very interesting -- I was going to -- just to respond for a second -- it would seem that the massive and rapid urbanization provides you an opportunity, though in this country, you know, urbanization has been a large carbon saver in a lot of places. It sounds like the transition from your rural areas, though, leads to a carbon acceleration.

MR. LIEBERTHAL: I thought, actually -- correct me, because I'm obviously wrong here, but my impression had been in the United States, people who live in cities are actually less carbon intensive than people who live outside of cities, right?

MR. MURO: Absolutely, that's why I think it would eventually become an opportunity for China.

MR. LIEBERTHAL: And that's exactly the opposite in China, when people move to cities they --

MR. QI: Well, in general, 75 percent of energy and 85 percent of the carbon emission takes place in cities all over the world, so that's pretty much the case, but when you compare here in this case in the United States, probably we're comparing different things. When you compare the cities versus the suburbs that can be different.

MR. MURO: Yeah, the first question has obviously interested us here a lot and, you know, we've done work on the carbon footprint of U.S. metropolitan areas and there's extreme variation. Density clearly reduces and is a meaningful -- you know, so, it seems like getting a handle on building -- not just building nature, but location and the spatial arrangement in your large metropolitan area seems like a really important --

MR. LIEBERTHAL: Yeah, I think the second question was -- how would you -- just to rephrase slightly -- how high a priority do U.S. companies put on energy efficiency? I mean, is that a major driver in most companies, or not really?

MR. MURO: My sense is it's increasingly for an, at times, large portion of the market and always a significant minority part of the market is being priced into goods becoming a driver of, you know, goods and services nature. And I think it is extremely important. I think we need to be thinking how are ways we can further incentivize companies with voluntary programs that structure the market in a way.

I mean, I think Energy Star is a very successful branding and signaling policy victory in this country that is probably underrated and will become important at a time where we may, for a few years now, have relatively thin federal policy.

MR. LIEBERTHAL: Good. Yes, back here, third row. This young lady.

MS. LU: Thank you. Sophie Lu, Regester Larkin Energy. My question is for Professor Qi Ye. I noticed that in some of your projections, natural gas does not really play a factor into China's projected 12th Five-year Plan for low carbon development, which is understandable since natural gas is pretty negligible for power generation in China currently.

But with the new global push into unconventional gas and China's new focus on that area, what are the prospects of natural gas becoming a more central component of China's long-term, low carbon development plans.

MR. YE: Well, Casey just mentioned this partnership, this cooperation between U.S. and China, the nonconventional and shale gas and others. This is an area under development right now -- quickly, the technology in China is not as advanced as in China. On the other hand, though, it's very different situation in terms of resources endowment and several companies actually went to China and tried -- and didn't really get much luck on that. They are very different.

But this is one area where we'll see very dynamic developments in the next couple of years. I think the prospect is as good as the technology advances.

Right now natural gas is just too precious for power generation. There are many other uses, you know, if people want to use it for now, but I think in the future, that would be a very, very important source of energy.

MS. DELHOTAL: Just to follow up on that. In the U.S., shale gas has actually been developed over decades and we are leading in it and we have the technology that I think most people in the world would very much like to use. It's extremely efficient.

We can recover a great deal with enhanced recovery techniques including CO2, and the Chinese have really wanted to engage with us on the shale gas issue.

And, you know, they have approached DOE. To be perfectly honest, DOE does not have that capability. It's a commercial technology, it's in our private sector, so we've done everything that we can to get the small companies as well as the big oil companies connected with the developers in China so that they can transfer the technology on a commercial basis.

I think China has enough emphasis on it that they will really push, and instead of being a ten-year lead, you're probably looking at five.

MR. LIEBERTHAL: Yes, back here.

MR. LICHTENSTEIN: Hi. Noah Lichtenstein, Monterey Institute of National Studies. So I was wondering, China has this 15 percent of total (inaudible 1:24:55.0) energy demand to come from non-fossil energy sources by 2020. But with the rapidly increasing energy demand, you talked about how even the energy intensity goal was hard to meet for this year. Do you think that's still a reasonable expectation for the Chinese power sector to meet? Or are other areas going to have to really start increasing their energy supply?

MR. QI: That target is certainly still there for the year of 2020, and before that target is being achieved, this 11.4 percent target for -- you know, by 2015 has to be achieved. So, we'll see -- you know, we'll watch closely whether or not that 11.4 percent. Right now it's just about 9 percent and it's going to be really challenging, it's going to be really challenging to achieve that.

But it's not impossible, but I would say it's going to be really challenging.

Some positive developments, though, is this domestic deployment, the solar panels and other -- wind, of course, the previously 95 -- 97 percent of the solar panels go exported to other countries. Now the policies are encouraging the domestic use of this type of generation.

So, we'll see.

MS. FRIEDMAN: Thank you. Hi. Lisa Friedman from ClimateWire. Professor, I interviewed you a couple years ago in Beijing. It's really nice to see you again.

I was struck at the beginning by something that you, Ken, said that not only has China surpassed the U.S. in emissions, but soon will be the largest historical emitter, and it occurred to me that I heard either Todd Stern or Pershing say that kind of

in passing in Durban. When? If you could talk a little bit about this, what's the timeline for this? Is there anything in the 12th Five-year Plan that you think will slow that inevitability?

And if I could ask a related question, I've seen a lot of different dates about when China may peak and then perhaps decline absolute emissions. If you could give us maybe your best assessment of when you think China would be able and willing to do that as well. Thanks.

MR. QI: Well, you're probably better to ask Ken, because Ken said that. China quickly surpassed the United States in -- I think that is possible. I do not have any data in the research on that. But I do show that the last -- the last year of -- I mean, 2010, the total amount is at 22 percent more emissions in China as compared to the United States. We also said by the end of 2015 it's going to be nearly 50 percent more in total amount.

Then in historical, cumulative, I don't really know. In terms of the peak, we are -- right now we have ongoing studies and you can -- we compared several different scenarios. You go some of -- you know, very ambitious ones by 2020, 2025, you can also find some other, you know, less ambitious ones, 2030, 2035, even beyond that.

So, that is the question I think a lot of people are interested in and I just want to point out, it's not just a technical number, it also depends on the ambition, the aspiration, you know, of the people in the government and the resources you want to dedicate into making that happen.

MR. LIEBERTHAL: I raised that issue, just to elaborate slightly, about cumulative emissions because back in 2007, 2008, 2009, China focused very much on the fact that even though China was becoming the world's largest emitter of greenhouse

gases, cumulatively, the U.S. accounted for a far larger percentage of greenhouses gases, actually, in the atmosphere.

And my feeling, then, and it is a much stronger feeling now and I think Qi Ye's remarks reinforce this, is after another few years, that won't matter. In other words, what matters is, who's putting greenhouse gases in the atmosphere now? That's where the politics moved to, and so it's very much related to the international pressure that will increasingly build on China to decide on a peak emissions year target and begin to make commitments around that, and that's a very tough thing as Qi Ye just indicated.

Yes, way back there.

SPEAKER: Hi, my name is Varoon, just graduated from UCLA, I'm starting to work at ARPA-E right now.

So, what I've been hearing is that the U.S. is a nation of innovation with the commercialization being exported. Just judging from what you guys have been saying, I think venture capitalists would agree, that when they fund these companies a lot of them turn towards across the Pacific for commercialization of their portfolio companies.

So, from a global standpoint, this is a public good because the cost of renewable generated electricity will go down, so deployed faster. From a nationalistic standpoint it's quite sad because U.S. incorporated companies are losing manufacturing jobs that are now going to China.

So, my question is, from a U.S. standpoint, is do you guys see -- or, how can this trend be reversed or is it even possible? Because, to be honest, I don't think China is going to give back manufacturing jobs that they now have. So, I just wanted your guys' comments on that.

MS. DELHOTAL: I can comment on that a little bit.

Solar panels and wind turbines are really global goods. The U.S. has a

$2 billion surplus with China in the solar industry area because we export to china the polysilicon, we export the equipment to manufacture the modules, other inputs into the modules. China actually assembles the modules based on their own designs or designs they jointly developed with us. They sell them back. And then there's another 50 percent of all solar jobs which are in the installation. So, as long as the U.S. is buying them, we have jobs in the solar industry.

It's way to interconnected to split apart at this point. I've seen statistics on wind where it shows the global -- you know, the content by country for a wind turbine installed in the U.S. versus China. Roughly, in both cases, 30 percent of it is made in China, 30 percent of it is made in the U.S. and 30 percent in other countries. Those percentages change a little bit because of where you install it, but basically these are global goods that are manufactured internationally and it's really, you know, the cat's out of the bag. You're not going to put it back into a nationalistic company that does everything in the U.S. and one that does everything in China.

So, this is one of the reasons why DOE is so concerned about, you know, some of these trade allegations is because it's not just about solar modules, it's about the entire industry and even if, you know, the U.S. is to put tariffs on modules, it not only hurts the installation jobs, but it hurts all of our exports to China.

MR. MURO: I mean, I'd just add one note. You know, I discussed the fragility of our subsidy environment. As that likely diminishes, even more tension and focus is going to go to the levelized price of these technologies, which means that innovation really is the main driver of getting massive scaling, so at any rate, wherever the production jobs are, we have to get to the delivery of electricity at a cheaper rate of renewables to -- and that's a global necessity and it's essential for American uptake as well.

MR. QI: I see the picture in that area is actually very dynamic and very interesting and exciting. Not only the capital -- the technology are going both ways, but also I just want to just highlight two examples of this, two manufacturers of solar panels in my hometown and they have now their facilities in California and another company in Idaho. So, I see this is a very exciting moment and very interesting area to watch. It has a lot of implications for the bilateral collaboration.

MR. LIEBERTHAL: This set of answers highlights two issues that are really worth keeping in mind. One is that, and this is generally true of Chinese exports to the United States, if you look across the full array of Chinese exports, two-thirds of the value of them consists of goods that China imported from elsewhere. Okay? Only one-third is value added in China. But the way trade statistics universally are calculated, 100 percent of the value of the export is attributed to China in U.S. trade statistics.

So, you really need to unpack where the value is to understand what's really going on. I have yet to find a member of Congress who is willing to do that. You know, I mean, it's complicated, but it's also real.

Secondly, one of the biggest potential areas of change in U.S.-China economic relations will be Chinese investment -- real investment, not portfolio investment -- into the United States. And investments in the clean energy area are one of the areas most ripe for that.

So, that's one of the really big things potentially coming up in the next decade that can change a lot of the nature of this conversation as we go forward.

Let's see, back here. I'm trying to jump around the room to keep everyone awake, so you never know when you're going to be called on.

MR. PORTO: Hi, Chris Porto with Deliotte Consulting in their sustainability and climate change group. My question is, how does China plan to attract

more foreign direct investment in renewable energy projects? From my understanding, the clean development mechanism has played a huge role in attracting foreign capital into actual on the ground projects to generate renewable electricity.

So, with the European Union now no longer accepting the carbon credits that those projects in China generate, how does -- are there any other plans to develop a new mechanism to attract foreign capital?

And my other question would be somewhat related to that, how do you see the regional carbon trading programs affecting either the absolute emissions or the emissions intensity moving forward?

MR. QI: My colleague Barbara Bookner here is an expert on not only the financing but also on that cap and trade I suggested. You know, after this you can probably talk to her.

The CDM I think has played an important role, but I'm not sure how critical that particular element played in attracting FDIs in this area. For instance, First Solar, one of the largest manufacturers, they were -- you know, big operation in China. They're there not just for CDM this probably has very little to do with the CDM but there are other factors.

In this delegation -- the last delegation when Secretary Locke was still there under Commerce and he brought the 24 companies, the CEOs of the major companies in renewable energy area and they were -- their discussion, they find opportunities, you know, making money and being -- to do well over there.

I think they also have complaints. They have complaints in terms of, you know, provincial policies on that. I think that probably has more to do with this moving, flowing of the capital in the investment.

I see that is still going on. However, I do see as the labor cost and the

higher environmental standard and other kind of costs going up also in China that this probably will add a new element in the flowing of the capital.

MR. LIEBERTHAL: Thank you. Back here.

MR. CLINE: In this country we --

MR. LIEBERTHAL: Name.

MR. CLINE: Bill Cline from the Peterson Institute. Didn't pass Waxman-Markey but we now have a huge debt problem and fiscal imbalance problem, and it's not totally out of the question that we could move to a carbon tax. And if you took the CBO's $25, $30 per ton of carbon dioxide and instead of doing that through tradable permits, it's just going to be a tax and it's going to be levied on sources of emissions.

Now, I grant you, this is a very hypothetical postulate, but if you were to accept that for a second, could you imagine China, and maybe the rest of the G-20, agreeing to do the same thing so that all the major players would have a comparable tax so that the whole argument about unfair trade would be set aside?

In short, whereas China, perhaps, has not been prepared to say, well, we're going to have targets of emissions just like Europe, but would it be more prepared to say, we are prepared to have the same tax level on carbon emissions that the United States and Europe adopt going forward?

MR. QI: I think that the distinction between tax domestically and this border adjustment tax is important. In terms of domestic tax, there is already a fuel tax, a gas tax, in China. It started December 2008, and China now is seriously considering a carbon tax across the board in China.

Then domestically, I don't know, probably Casey and Mark can tell you more about this, I see a domestic carbon tax or even a gas tax is going to be really hard here in the United States, not to mention a carbon tax, in this country. I think that would

be really, really good progress to be made.

In the broader tax, I think that's a lot more complicated issue. If you put a border adjustment tax in between U.S. and China, it probably -- if you really look at the data, it probably doesn't really matter that much in terms of the carbon emission, embody (?) the carbon emission between the two countries. But it's going to be -- this certainly will generate a lot of treaty issues, for sure.

So, I think I would like to wait and see how that will be played out in the future.

But I think, almost surely, almost surely, we'll see a cross-border carbon tax within China. And I hope we can see that here too.

MR. LIEBERTHAL: Amen to that. Yes, sir?

SPEAKER: Chia Chen, Bethesda, Maryland. Casey, first, thank you for your comments and your service to the nation. I have two questions for you.

First is this, coal is both important to U.S. and China. What's the current status of the critical technology and also what's the coal gasification project? And second is this, what's the current direction of the DOE National Laboratories? Thank you.

MS. DELHOTAL: So, the first question about coal, we are actually doing quite a bit with the Chinese, particularly Huaneng, which is an energy company in China. They have a demonstration project of carbon capture and storage on their Shanghai plant, so one of the things we're doing is actually working with them to bring their technology to the U.S. to demonstrate it here to show that they are getting the capture rates that they are seeing in Shanghai and that it actually meets the cost estimates that they're showing.

But overall what DOE is doing on coal is we have roughly eight carbon capture use and storage projects in the U.S. that we have put funding towards. These

are all considered subsidized projects so the DOE has put up roughly $400 million for each of these projects.

Coal projects of this size are roughly $2.5 billion, so they've also had to go out and get private capital. The Chinese government, as well as some of the private sector in China, is interested in actually investing directly in some of these projects.

These projects are taking U.S. coal, building a high efficiency ultra super critical plant, they're capturing the carbon, they are then using the carbon generally for enhanced oil recovery. This is happening particularly in Texas. A lot of people don't realize this, but we use a lot of CO2 in the Gulf of Mexico region to do enhanced oil recovery already.

There are two big major pipelines in the U.S. that transport CO2. Many of these projects either tap into to that pipeline or they are on site of old, depleted oil areas where they would then use the CO2 to get returns out of the depleted areas.

These things, you know, the money was obligated two years ago, roughly. We expect the time between that and actual build out to be five to seven years. They have to get permits in their states, they have to get drilling permits, in many cases, from EPA. They have to get the private sector financing. So, there's a lot going on.

We have been engaging with the Chinese to bring direct investment into those projects. China is very interested, we're very interested in what they're doing, so it's a good way to demonstrate both of our technologies and really, like I said, innovate and get the problem solved.

In the area of the labs, we have roughly 24 national laboratories, many -- I'm sure many people have heard, like Lawrence Berkeley National Lab, but you may not have heard of Sandia or some of the smaller -- Jefferson Lab. Ten of those are considered weapons labs and are more or less off limits to most foreign governments.

Ten of those are science labs and focus very much on basic research, though they do expand out into some of the other areas like energy efficiency and materials development. And then we have roughly four labs that actually do like the next generation nuclear power, traveling wave reactors, chemical -- new chemicals for batteries, that kind of thing.

Almost -- probably 13 of our labs are actually directly involved with either the Chinese government or a university in China or one of the research institutes in China and it's everything from energy efficiency, auditing and industrial plants, to physics to, you know, almost anything you can think of. We even -- one of our labs even does nonproliferation training for the border patrol in China to help detect at ports radioactive material.

So, we have actually a wide range of activities in our labs that are ongoing and many of them were started in the '90s.

Coal gasification is not a popular technology here in the U.S. but we have many companies that do have the technology and have demonstrated it here in the U.S. and we actually have several big commercial deals between private sector companies -- U.S. private sector companies and Chinese private sector companies to demonstrate and use the technology in China.

So, I believe the latest one is LP Amina has signed a deal that will do a large coal to liquids project in China in one of the coal abundant areas and then sell the liquids to the east coast.

MR. LIEBERTHAL: Okay, we have time for one more question, and that's back there. And then I'm going to give each of you, if you want to take it, one minute for any final summary comments you want to make.

SPEAKER: Lin Zhen from University of Maryland. Actually, a follow up

on a previous question covering capture and storage -- use and storage now. Scientifically, it's really not proven how much we can really store, how long they can stay. The scientific community has been working hard but there is no really clear, strong evidence this can really achieve what many projections say, like they (inaudible) typically two to three (inaudible) with CCUS. What is DOE's current projection and expectation of that?

MS. DELHOTAL: I don't think we have a specific -- you know, I can't tell you that it's, you know, 60 percent versus 90 percent sure that we can keep it underground for 200 years, 500 years.

What DOE's philosophy has been about these technologies is that there's no magic bullet and CCUS is not going to be the magic bullet that I, you know, when I was doing climate mitigation work, you know, earlier on in my career, CCUS had just come out and everybody thought it was just going to take care of the problem. You stuck it in the economic models and everything went away.

What we think, it's going to take a portfolio of different technologies and CCUS is one of those. And what we're trying to do is do these demonstration projects and actually get them into oil wells that, you know, have been drilled, some of them they have been drilled very efficiently, some of them maybe not so well, and see how it works.

Until you get it in the ground and you measure it, given the type of rock it's in, you know, given the type of drilling that has been used to make the well, you can't really tell what it's going to do. You can do a lot of computer simulation, but until you have some real world experience, it's going to be very hard to come up with those kind of numbers.

But I think it's going to play a roll in the overall mitigation of climate change gases.

MR. LIEBERTHAL: Thank you. Let me ask you whether you have any final few remarks that you wish to make, and why don't we just go right down the line. Qi Ye?

MR. QI: Yeah, let me just go quickly. From Casey, I have learned today, really a lot is going on in collaborations, energy efficiency, renewable energy, in this whole area, which is really exciting, which is going to help to push the technology. I see -- I mean, I've become a lot more optimistic today than before.

And secondly, listening from Mark, and I think it would be a very good idea for the local governments between the two countries to talk to each other, then that will help for this collaboration also to consider their own policies and actions.

And from this conversation, the gentleman over there, I just reflect more on consumption sector, consumer behaviors. When you look at the energy consumed, carbon emitted, China consumption one-third and production two-thirds. U.S., consumption two-thirds and production one-third, I mean, roughly.

So, to avoid the -- you know, going -- I mean, right now it's still like four times per capita in differences -- to avoid going that way, I think this a really, really important area to keep an eye on.

MR. LIEBERTHAL: Great. Thank you. Casey.

MS. DELHOTAL: I think I came up with some of the same conclusions you did. I think it's very important to have some of the sub-national cooperation going on. I feel like the U.S. government's been very successful in reaching out to the Chinese government and doing it at the national level, but there's still a lot of work.

We have been interested in doing some of the sub-national work. We have actually, at DOE, done some mayor's training, for example, some work at the -- trying to get mayors, governors interested in these technologies and understand that

these technologies can really be beneficial and, in may cases, save the province money or the city money.

It's, you know, always nice to hear that our states are a little ahead of our national government on climate change. It makes me feel a little bit better. But it would, you know -- I would like to see sort of the next steps in DOE's relationship as helping facilitate some of these sub-national arrangements.

MR. LIEBERTHAL: Yeah. Mike?

MR. MURO: And I just want to say I'm grateful to Ken for putting this together and the China Center and it's fascinating to hear from Qi Ye and Casey for greatly elucidating the complexity of these issues in each country and the richness, really, of the bilateral activity going on. I wasn't aware of the full array.

I am somewhat encouraged and intrigued also. I think it is -- I'll throw another sort of contact that may make sense, which is for U.S. localities to talk to the national government in China. And it seems like there may be right now symmetry of interest there and also with some of your capital centers.

You know, I think there's, in some ways, a very willing and dynamic and active, very pragmatic leadership in U.S. -- especially metropolitan areas and cities, who may be, you know, eager collaborators with China. So, fascinating and appreciate your --

MR. QI: Can I say one more word? I take this opportunity to thank my colleagues who helped me put together my slides and to you, Ken, thank you so much.

MR. LIEBERTHAL: Thank you. This is an extraordinarily important issue. I want to remind you that there will be a full transcript of this posted by early next wee so you can go back and capture the full richness of it and this was really an exceptionally good discussion.

So, thank you all and please join me in thanking our panelists.

(Applause)

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